Fisk, Eugene Lyman

Discussion of
Dr. Louis I. Dublin's...

[S.l.]

[1921]

97-84132-26
MASTER NEGATIVE #

COLUMBIA UNIVERSITY LIBRARIES
PRESERVATION DIVISION

BIBLIOGRAPHIC MICROFORM TARGET

ORIGINAL MATERIAL AS FILMED - EXISTING BIBLIOGRAPHIC RECORD

Fisk, Eugene Lyman, 1867-1931.
Discussion of Dr. Louis I. Dublin's paper on "The work of Dreyer in relation to life insurance examinations"; read before the Association of life insurance medical directors, New York, October 21, 1921, by Eugene Lyman Fisk ... ⸢1921⸣
11 p.

Caption title.
"References": p. ⸢12⸣

112205

ONLY C.

TECHNICAL MICROFORM DATA

FILM SIZE: 35mm REDUCTION RATIO: 10:1 IMAGE PLACEMENT: IA IIA IB IIB

DATE FILMED: 7/7/97 INITIALS: A.P.

TRACKING # : 25588

FILMED BY PRESERVATION RESOURCES, BETHLEHEM, PA.

DISCUSSION OF

Dr. Louis I. Dublin's Paper on

"The Work of Dreyer in Relation to Life Insurance Examinations"

Read before the Association of Life Insurance Medical Directors, New York, October 21, 1921

by

EUGENE LYMAN FISK, M. D.
Medical Director
Life Extension Institute

This Association has made a very valuable contribution not only to life insurance medicine but to clinical medicine in presenting this study of Professor Dreyer's method. Dr. Dublin, with his usual penetration and thoroughness, has applied to this method the criteria employed in the consideration of large masses of lives, thus supplementing and testing the evidence derived from the more individualistic work of the clinician. He has clearly pointed out the weak spots in the mathematical structure of the theory but refrains from tearing it down. If in discussing this paper I venture to cover some of the same ground so admirably covered by Dr. Dublin, it is to present the reaction of the medical man in terms of office practice to the weak and strong points of the method.

It is important to examine this method (first) as to its clinical value; and (second) as to its value in life insurance, hygiene and preventive medicine as a means of determining physical fitness. I heartily agree with Dr. Dublin in raising a question as to Professor Dreyer's use of the term "physical fitness." Does he mean, as it is practically asserted in the introduction to his treatise, fundamental physical fitness, underlying resistance to disease—in a word, longevity—or does he mean present physical fitness or well being? I am aware that clinicians often err in confusing immediate physical fitness or a condition in which the organs are in balance and functioning up to the normal, with fundamental physical fitness or a physical state free from underlying physical defect or lowered resistance to disease. This confusion of ideas with regard to physical

fitness is one of the greatest obstacles to the progress of personal hygiene and physical upbuilding of the nation's health and we know that it is the first lesson that those entering the field of medical selection for life insurance *must* learn.

We can readily think of many conditions that would not affect the vital capacity in people originally well developed, for example, gall stones, incipient kidney trouble, focal infection in its initial stages, even latent syphilis. There is nothing in the Dreyer studies to show that the vital capacity in a wide range of possible sub-standard conditions which experience has demonstrated affect physical fitness and longevity, is materially reduced. There is a certain contradiction in his statement on the one hand that these tests are measures of fundamental physical fitness, and on the other hand, that they bear no necessary relationship to physical defects.

Putting this aside for the moment, we can perhaps do better justice to this method if we first examine it on the positive side. From a study of the literature and some experience with the method in the office of the Life Extension Institute, I think it may be fairly stated that vital capacity tests have a high clinical value, especially in marking the clinical progress of a patient. Also I think we may accept the fact that a very low vital capacity reading indicates a sub-standard condition of health. This, however, according to Dreyer's own findings, may be a temporary condition. He plainly states that the vital capacity is materially influenced by activity and environment and that it is not necessarily a reflection of fundamental condition or type. When we examine the values of normal or super-normal vital capacity readings as evidence of physical fitness we are, as Dr. Dublin points out, by no means on such secure ground, taking Professor Dreyer's evidence as it comes. In his studies at the Brompton Hospital of 200 cases, he emphasizes the fact that 17 of the hospital staff known to be normal, showed normal vital capacity; but he ignores the fact that out of 116 cases known to be pathological, 30% showed vital capacity within the normal range—that is, either slightly above the normals he has fixed or less than 10% below. It is clearly apparent from his studies that a subject with active, though very much improved, tuberculosis may register a normal vital capacity. Of course the clinical attitude of mind toward such a case is extremely favorable—an expectation of a permanent cure is justifiable —but we know from mortality experience on such cases that the risk is in a sub-standard class.

Peabody and Wentworth's studies at the Peter Bent Brigham Hospital give further evidence of the clinical value of vital capacity readings, especially in heart disease. Here again, however, we meet the limitations of this test. Lowered vital capacity readings are apparently only found in those cases where there are secondary signs such as dyspnea or a failure of compensation. For example, 25 cardiac cases without dyspnea showed 90% or better vital capacity. One of these had a low grade endocarditis. Forty-one cardiac cases, with a history of dyspnea, showed 70 to 90 per cent vital capacity.

One cardiorenal case (since died) showed 76%. One double mitral and auricular fibrillation, at work one year after observation, showed 74%. A cardiorenal case, 85%. A group showing 40 to 70 per cent vital capacity presented severe advanced conditions with dyspnea. Another group, bed-ridden, showed 40 to 45 per cent. We see here a very close agreement between vital capacity readings and the general physical state. Nevertheless it is evident that this is a partial functional test and subject to the limitations of all functional tests that we employ, such as renal efficiency, blood pressure, blood chemistry and the like. Normal readings do not necessarily exclude the possibility of fairly well advanced organic change or fundamental physical insufficiency that would justify placing the individual in a high mortality class.

It is true that Peabody and Wentworth's normal standards were rather roughly fixed and based upon height, as follows:

MEN		WOMEN	
6′	5,100	Over 5′ 6″	3,275
Over 5′ 8½″ to 6′	4,800	Over 5′ 4″ to 5′ 6″	3,050
5′ 3″ to 5′ 8½″	4,000	5′ 4″ or less	3,825

According to our observations, however, these normals are high for the class of people examined and the general testimony squares with that derived from Dreyer's studies at the Brompton Hospital.

These clinical observations lead us to the conclusion that from the standpoint of life insurance medicine and the "assessment of physical fitness," to use Dreyer's own term, the test has a distinct value; but, also, very distinct limitations. In other words, it is a test which may often times contribute valuable information as to the physical future of an individual, when considered in relation to the family and personal history and other evidence derived from a general physical examination. There is also a possibility that by taking the weight in relation to the stem height, individuals may be more accurately classified. We have already noted individuals, apparently physically fit except for 20 to 40 pounds underweight according to the standard tables, who were exactly normal in weight according to the Dreyer tables, and we know what a low mortality was found in the medico-actuarial investigation among well selected, extremely underweight types. An extreme instance of the unreliability of total height and body weight as indices of physical condition is the gorilla who measures 5 feet 1, and weighs 418 pounds. With legs proportionate to the body as in man, he would measure 7½ feet and weigh over 500 pounds.

This discussion would not be complete without reference to other tests of respiratory efficiency. The Journal of the American Medical Association, in severely criticising the Dreyer methods, rightly insists upon the fact that total respiratory efficiency cannot be determined by merely measuring the volume of air respired, as

efficiency involves not only chest volume but circulatory, blood and tissue conditions. It seems important, therefore, to consider the Flack tests, which include breath-holding, expiratory force tests and expiratory fatigue tests. These were employed by Flack in the examination of candidates for the Royal Flying Corps and in checking up the condition of flyers. In the breath-holding test the subject expires deeply, then fills the lungs fully, and with the nose clipped holds the breath as long as possible. In the expiratory force test, the subject blows a column of mercury in a U tube as high as possible, the result being recorded as in blood pressure by millimeters of mercury. In the fatigue test, the subject blows the mercury after full inspiration to a height of 40 millimeters and holds it there without breathing as long as possible.

In studying the results of these tests I have been impressed by the fact that the expiratory force test and fatigue test are more reliable in revealing fundamental physical unfitness than the vital capacity tests and are quite as consistent in their testimony as to physical fitness. It should be remembered that both the vital capacity and the Flack tests show a high possible range above normal, depending upon the individual, his activities and the original physical endowment, as well as present condition of health. The following table from Flack's report will make clear the more positive significance of the U tube tests:

FIT GROUPS

	Vital Capacity (C. C.)	Breath-Holding Test (Seconds)	Exp. Force Test (Mm.)	Fatigue Test (Seconds)
(1) Fit flight commanders, etc.....	4,062	67	112	52
(2) Fit home defense pilots.......	3,940	72	119	50
(3) Cadets	3,823	69	106	51
(4) U. S. Cadets	3,814	66	116	53.5
(5) Delivery and test pilots.......	3,620	57	108	40
Average	3,852	66	112	49

UNFIT GROUPS

	Vital Capacity (C. C.)	Breath-Holding Test (Seconds)	Exp. Force Test (Mm.)	Fatigue Test (Seconds)
(1) Pilots taken off, showing stress	3,480	49	74	25
(2) Hospital cases	3,560	54	87	35.5
Average	3,520	51	81	30

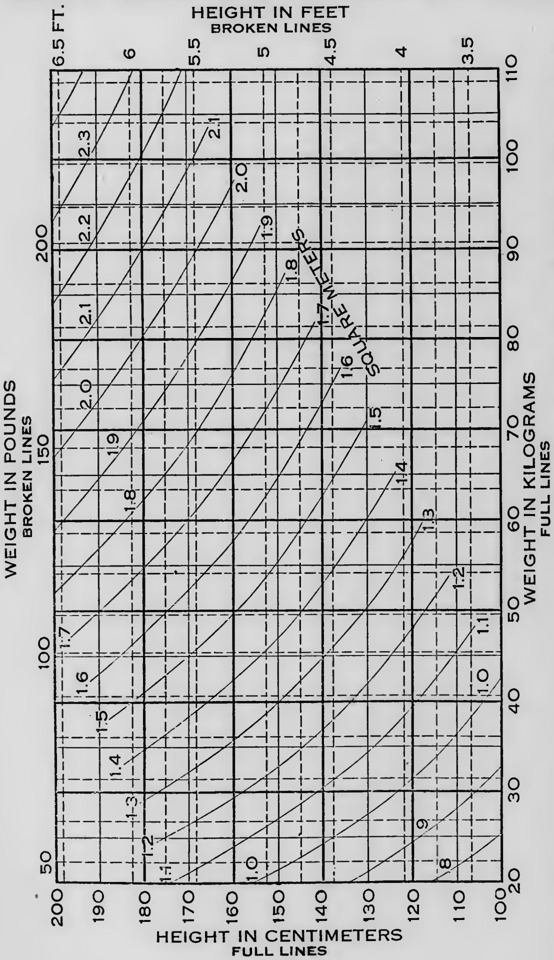
Note that in unfit classes the average drop in vital capacity was less than 10% below the average vital capacity of the fit classes. But the drop in the expiratory force was 29%; in breath-holding

22%; and in the fatigue test 40%. I am inclined to believe that in these U tube tests we have a more convenient, and perhaps more consistent method of determining the total physical condition of the individual. It should be remembered that the expiratory force test does not measure the vital capacity or volume of air that can be forcibly expired over and above the residual air. It is a measurement of muscular and nervous tone. Theoretically it should be of value in early tuberculosis if, as Lundsgaard and Van Slyke claim, there is in this condition an increase of residual air and reduced vital capacity due to impaired movement of the diaphragm and chest walls. Also we would expect *a priori* that a reduced physical state would impair the power of the chest walls and lower the endurance as shown in the low ratings derived from the breath-holding and fatigue tests in unfit subjects. If these Flack tests prove of high practical value, they can be readily combined with blood pressure observation and perhaps some relationship between blood pressure changes and the Flack ratings established, as well as between the Flack ratings and the vital capacity. A more satisfactory test of the circulatory reserve than we now have may eventually be devised through this method.

Heald and Thompson have endeavored to derive a formula that will combine the Flack and the Dreyer tests, but this is as yet in an experimental stage.

As to the practical use of the Dreyer tables in clinical and life insurance work, this presents many difficulties but they are not insuperable. In both clinical and life insurance work, it is desirable to reduce the method to the simplest form compatible with accuracy, and the question of apparatus must also be considered if the test is to be widely employed. If the subject is of normal weight, it is a simple matter to find the vital capacity reading in the Dreyer table and judge the individual according to his class. Many people will depart materially from the normal weight and then the procedure is more complex. In a study of the work done at various centers, I am impressed by the value of West's investigations at the Peter Bent Brigham hospital and Harvard Medical School. Following out Dreyer's own suggestion that the vital capacity is a function of the surface area of the body, he has developed a simple arithmetical formula that can be applied to the surface area of the body. The surface area can be readily ascertained from the graphic chart of Dubois & Dubois, presented herewith, which has been adapted for practical clinical use with the apparatus for determining basal metabolism.

BODY SURFACE CHART (DRS. DU BOIS)



Plotted from the Du Bois new formula for Body Surface which is: Area in square centimeters equals Constant 71.84 times Weight of person in kilograms raised to the 0.425 power times Height in centimeters raised to the 0.725 power. See *Archives of Internal Medicine*, June, 1916. Vol. 17, part 2, pp. 863-871.

This graphic chart is very similar to Dr. Rogers' weight chart. With the net weight and height known, the body surface in square meters can be ascertained from the chart and this factor multiplied by 2.5 litres gives the normal vital capacity for men in liters; and multiplied by 2 litres gives the normal vital capacity for women. I have tested this formula for various heights and weights and find that the results closely approximate the Dreyer standards of Class A for men. I have found that Class B is 8½% less than Class A; Class C 14½% less than Class A. Women as a class are 13% below men in vital capacity in the Dreyer tables, and the difference in the classes is in the same ratio as among men. (The surface area method, is however, more accurate for women.) These figures give us short-cuts to computing normal vital capacity and the departures therefrom shown by those tested. In using the body surface method, the class of the individual as determined by his actual occupation and environment should be fixed and then his actual vital capacity compared with the standard for his class as determined by the factors given. He may,. of course, finally be placed in a lower or higher class than his occupation and environment indicate. Professor Dreyer's rough classification of occupation does not square with life insurance mortality experience yet may be found accurate from vital capacity standpoint.

I also submit a table I have worked out showing among males the cubic centimeters of vital capacity per pound for all weight groups. For people of normal weight this table can be readily used together with the other factors I have already noted for determining the class and the vital capacity rates for women. As Dr. Dublin points out the vital capacity as based upon weight is more accurate than that based upon height, but the body surface and height seem by far the simplest and most direct method.

MEN

Pounds				Cubic Centimeters				
40	to	44	x	42	=Vital	Capacity,	Class	A
45	to	49	x	41	"	"	"	"
50	to	54	x	40	"	"	"	"
55	to	50	x	38	"	"	"	"
60	to	64	x	37	"	"	"	"
65	to	74	x	36	"	"	"	"
75	to	79	x	35	"	"	"	"
80	to	89	x	34	"	"	"	"
90	to	99	x	33	"	"	"	"
100	to	114	x	32	"	"	"	"
115	to	124	x	31	"	"	"	"
125	to	144	x	30	"	"	"	"
145	to	159	x	29	"	"	"	"

ALL OTHER CLOTHING INCLUDING SHOES

Small ....4 lbs. 3⅓ oz.
Medium ....4 lbs. 12 oz.
Large ....5 lbs. 2 oz.

AVERAGE WEIGHT OF CLOTHING (WOMEN)

Dress and Corsets

	Tropical	*Mid-summer*	*Winter*
Small	1 lb. 11 oz.	2 lbs. 8 oz.	2 lbs. 11 oz.
Medium	1 lb. 14 oz.	2 lbs. 12 oz.	2 lbs. 15 oz.
Large	2 lbs. 4 oz.	2 lbs. 15 oz.	3 lbs. 5 oz.

ALL OTHER CLOTHING INCLUDING SHOES

	Tropical	*Mid-summer*	*Winter*
Small	1 lb. 15 oz.	2 lbs. 10 oz.	3 lbs. 6 oz.
Medium	2 lbs. 1 oz.	2 lbs. 12 oz.	3 lbs. 8 oz.
Large	2 lbs. 12 oz.	3 lbs. 6 oz.	4 lbs. 6 oz.

AVERAGE WEIGHT FOR ALL SEASONS

Dress and Corsets

Small ....2 lbs. 4⅔ oz.
Medium ....2 lbs. 8⅔ oz.
Large ....2 lbs. 13⅓ oz.

ALL OTHER CLOTHING INCLUDING SHOES

Small ....2 lbs. 10⅓ oz.
Medium ....2 lbs. 12⅓ oz.
Large ....3 lbs. 8 oz.

In regard to the Flack tests, the relationship of the findings to physical condition have not been so minutely worked out as in the case of vital capacity. It is notable in Flack's report that all the fit classes registered well above 100 in the expiratory force test, yet the minimum normal was fixed at 80. The fatigue tests average 48 among fit classes; low normal has been fixed at 40. The breath-holding tests average 66 seconds among the fit classes; low normal would here appear to be between 55 and 60. In our own observations we have found very low readings for women in the expiratory force

Pounds				Cubic Centimeters					
160	to	189	x	28	=Vital	Capacity,	Class	A
190	to	209	x	27	"	"	"	"
210	to	219	x	26½	"	"	"	"
220	to	234	x	26	"	"	"	"
235	to	249	x	25½	"	"	"	"
250	to	269	x	25	"	"	"	"
270	to	289	x	24½	"	"	"	"
290	to	299	x	24	"	"	"	"

Note:—Class B, 8½% less than Class A; Class C, 14½% less than Class A.)

WOMEN

Class A—13% less than Class A for men.
Class B—8% less than Class A for women.
Class C—14½% less than Class A for women.

Therefore the following formula may be applied:

V. C. Class A (Men) x .915 = V. C. Class B (Men)
V. C. Class A (Men) x .855 = V. C. Class C (Men)

In ascertaining normal vital capacity for women it is preferable to apply the surface area method, i. e., surface area in square meters x 2 liters = V. C.

As the net weight is not readily secured in life insurance examinations and estimates of clothing weight may be very inaccurate, the following table from "How to Live," giving the weights of clothing, may prove useful for reference:

AVERAGE WEIGHT OF CLOTHING (MALES)

Coat and Vest

	Tropical	*Mid-summer*	*Winter*
Small	1 lb. 3¾ oz.	2 lbs. 1½ oz.	2 lbs. 8¼ oz.
Medium	1 lb. 5 oz.	2 lbs. 4¼ oz.	2 lbs. 11¼ oz.
Large	1 lb. 8 oz.	2 lbs. 9 oz.	3 lbs. 1 oz.

ALL OTHER CLOTHING INCLUDING SHOES

	Tropical	*Mid-summer*	*Winter*
Small	2 lbs. 8 oz.	2 lbs. 9 oz.	.5 lbs. 9¾ oz.
Medium	3 lbs. 11 oz.	4 lbs. 11 oz.	5 lbs. 14 oz.
Large	4 lbs. 1 oz.	5 lbs. 1 oz.	6 lbs. 4 oz.

AVERAGE WEIGHT FOR ALL SEASONS

Coat and Vest

Small ....1 lb. 15 oz.
Medium ....2 lbs. 1⅔ oz.
Large ....2 lbs. 6 oz.

tests; normal, fairly active women showing normal vital capacity had difficulty in registering 80, and low normal would appear to be in the neighborhood of 50. A woman who cannot register 50 in this test or a man who cannot register 100 are open to question as to their physical condition.

All of these tests are liable to error through lack of intelligent cooperation on the part of the subjects, and unless one can be sure that there is full cooperation the reading should be rejected and excluded from any statistical studies.

Practical difficulties will be encountered in the examination of women if chest measurements are employed in view of the wide variation in mammary tissue. We have met this difficulty in our own observations and Professor Dreyer's formula for correcting these readings does not work in our practice. Perhaps the chest volume, as suggested by Garvin, Lundsgaard and Van Slyke, would be a more accurate factor for women but this likewise involves the taking of so many measurements that the probability of error on the part of the average observer is increased. The body surface in relation to height is perhaps the safest method. These standards are lower than the Dreyer tables by 7% for women but from our observations I believe these standards are more accurate.

The risk of applying these tests in advanced disease must be considered. J. A. Myers states that Professor Dreyer has observed no unfavorable reaction, but our observations show the contrary, and we advise caution in applying any of these tests in advanced pulmonary or circulatory conditions. We have made a considerable number of observations on the influence of these tests on blood pressure and find that the blood pressure is increased from 10 to 30 millimeters during the test. In serious conditions the patient should be asked to do only what can be done without manifest distress or unfavorable reaction, and in this way secondary standards for advanced cases might be established. Just as it is hazardous and unwise to ask a patient suspected of myocardial insufficiency to hop 100 times on one foot, so is it unwise to push these tests to the limits necessary for correct readings in average people.

As to apparatus, spirometers are not generally available on the market. An instrument such as is exhibited here today is made by the Sanborn Company at Boston but is quite expensive. There has been so little demand for these instruments that no convenient, economical and simple portable form has been made available. The instrument made by Boulitte in Paris and recommended by Dreyer is no doubt more convenient and portable than the standard type. If these tests are carefully tried out in various clinical centers, head offices and important branch offices of insurance companies and in other places where physical conditions are assessed, and their apparent value confirmed, no doubt they can be more commonly utilized by the average examiner. The present widespread use of the sphygmomanometer may be credited to life insurance medicine. By requiring the blood pressure in examining for life insurance, this simple

but valuable clinical resource has finally passed into the hands of practically all physicians, although it is not so many years ago that it was considered chimerical to attempt to secure these readings from the average examiner. Bearing carefully in mind, as I have already suggested, the limitations of all efficiency tests, it would seem that we are leaving something very important undone if we do not ultimately develop some simple and practical method of testing respiratory efficiency as a supplementary procedure to auscultation and percussion just as we have developed circulatory tests, which do not by any means take the place of the physical examination of the heart but often give information which could be obtained in no other way.

I regret that the invitation to discuss this paper was not received in time for me to make more extensive original observations as to the value of these tests. I present the following studies, however, for what they are worth and I can promise you that by next year we will have from five to ten thousand observations on people of all classes, examined with great care by our Head Office physicians and technicians, from which it may be possible to draw more positive conclusions than can now be confidently drawn from the comparatively meagre data available.

Fifteen sub-standard men, including some organic cases, gave following readings:

Vital capacity for Class ....—13%
Vital capacity below Class A ....—20%
Vital capacity compared to surface area standard............—24%
Expiratory Force (33% below standard) ....67 m.m.

Ten men apparently free from important defects:

Vital capacity for Class ....—2%
Vital capacity as compared to Class A ....—11%
Vital capacity as compared to surface area standard..........—14%
Expiratory Force (30% below standard) ....70 m.m.

Twenty sub-standard women, including some organic cases:

Vital capacity for Class ....—21%
Vital capacity as compared to Class A ....—30%
Vital capacity compared to surface area standard ....—29%
Expiratory Force (32% below standard) ....34 m.m.

Ten women apparently free from important defects:

Vital capacity for Class ....—10%
Vital capacity as compared to Class A ....—17%
Vital capacity as compared to surface area standard..........—16%
Expiratory Force (20% below standard)...................40 mm.

As to the sufficiency of the material on which Professor Dreyer has based his elaborate tables, we have learned to respect the testimony derived from small groups carefully selected, and it may be that as Professor Dreyer claims future investigations will not materially alter the standards he has fixed. I believe it to be true,

however, that as Dr. Dublin has suggested, the further use of these tests may show them to have even a wider range of usefulness than Professor Dreyer claims. On present evidence, however, I think we must regard them simply as tests, and not as offering infallible testimony with regard to underlying physical fitness or longevity.

REFERENCES

Dreyer, Georges. The Assessment of Physical Fitness. Paul Hoeber, 67-69 East 59th Street, New York.

——— Investigations on the Normal Vital Capacity in Man and Its Relation to the Size of the Body. Lancet, (London), 1919, v. cxcvii, no. 5006, pp. 227-34.

——— and L. S. T. Burrell. The Vital Capacity Constants Applied to the Study of Tucerculosis. Lancet (London, 1920, v. cxcviii, no. 5049, pp. 1212-16, June 5, 1920.

Garvin, A., C. Lundsgaard and D. D. Van Slyke. Studies of Lung Volume. Journal Experimental Medicine, 1918, v. xxvii, pp. 87-154.

Peabody, F. W. and J. A. Wentworth. Studies on the Respiration. The Vital Capacity of the Lungs and its Relation to Dyspnea. Archives Internal Medicine, 1917, v. xx, no. 3, pp. 443-67.

Vital Capacity and Physical Fitness. Editorial, Journal American Medical Association, 1921 v. 77, no. 14, pp. 1105-06.

Flack, Martin. The Medical Requirements for Air Navigation, Lancet (London), October 23, 1920, pp. 838-42.

Heald, C. B. and B. Thompson. The Value and Interpretation of Some Physical Measurements. Lancet (London), 1920, v. cxcix, no. 5067, pp. 736-41.

West, H. F. A Comparison of Various Normal Standards for the Normal Vital Capacity of the Lungs. Archives Internal Medicine, 1920, v. 25, no. 3, pp. 306-16.

Meyers, J. A. Studies on the Respiratory Organs in Health and Disease. Journal-Lancet, 1921, v. xli, no. 9, pp. 252-57.

Great Britain—Reports of the Air Medical Investigation Committee. Flack and Hanson, nos. 3 and 6. London, His Majesty's Stationery Office. (Special report series No. 53.)

END OF TITLE